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become well known until too late for insertion ; but we hope it may find a place in a future edition. The telephone has a chapter devoted to it. We wish that the theory of the instrument had been stated more at length, and are surprised to find not even a reference to the musical telephone of Reis.

The preceding remarks apply especially to the latter and technical portion of the book. The earlier chapters, which treat of various theoretical matters, are less worthy of praise. The definitions of electrical units are in some cases far from clear. Some of the remarks on p. 96, regarding the unit of capacity, are quite misleading. There are also some apparent slips of the pen. Such, for example, is the statement on p. 119, that the resistance of a battery increases in direct proportion to the number of cells, which is evidently true only when the cells are connected entirely in series. To the same origin we may probably trace the erroneous statement on p. 94, regarding the use of the terms 'weber' and 'weber per second.' The chapter on electrical measurements seems rather to be compiled from text-books than derived from the writer's knowledge of such experimentation, and hence fails to have the suggestiveness that is found in some portions of the book. The few pages devoted to electrotherapeutics are unworthy of the title, and do not deserve insertion in a separate chapter ; and more discrimination might well have been employed in the descriptions of the various electric lamps. The question-and-answer style is a disadvantage, which would be removed by the substitution of proper marginal titles.

#### A NEW CLASSIFICATION OF THE MOLLUSCA.

*Encyclopaedia Britannica*. 9th ed., vol. xvi., pp. 632-697. *Article, Mollusca*. By E. RAY LANKESTER.

As a rule, it is hardly in the ponderous tomes of an encyclopaedia that one looks for new, fresh, and breezy contributions to biology, or for epoch-making articles on biological topics. One rather expects the carefully weighed and sifted results of investigation which has already borne the test of publication and discussion, prepared for general comprehension by a divestment of all unnecessarily technical terms. In the present instance, whatever be the feelings of the layman who may refer to it, the scientific student of the Mollusca will be agreeably disappointed. It is rumored that the distinguished author has in preparation a manual of the invertebrates, of which it may be assumed

this article is the forerunner. For this reason, even in our limited space, which forbids a really thorough discussion of so large a topic, it is desirable that the attention of specialists should be called to it.

The school of which Professor Lankester is one of the leaders is marked by certain well-recognized features. They have broken away from the fetters of all previous zoölogical classification. Armed with the latest instruments and methods, they attack biological problems with ardor, and rarely fail to add materially to our knowledge, whatever be the subject treated. A new biology has arisen, and the gospel thereof is pedigree. By their ancestral trees shall ye know them, under whatever adult garb they may conceal themselves, — this is the new law of the new prophets.

So great a truth is contained in it, so rich the harvest under its stimulation, and so unanimously has it governed the generation first brought under its beneficial influence, that even yet to doubt its infallibility and ubiquity of application is to stigmatize one's self as a biological Philistine. Nevertheless, it is becoming pretty generally admitted that the relations of pedigree fail, in many cases, to express adequately the relations of adult animals as we find them in nature ; and that the genealogical stand-point, like any other single stand-point, taken by itself, is inadequate to the broadest and truest view.

Professor Lankester's work has the merits of his school in a very decided degree, while some of its faults are equally well marked. These we shall endeavor to point out, though limitation of space will compel us to do much less than justice to both.

"The Mollusca," he tells us, "form one of the great phyla or sub-kingdoms of the animal pedigree or kingdom." After a very slight sketch of the history of molluscan classification, the works of Woodward and Bronn are mentioned with deserved approval, the latter being termed "the most exhaustive survey of existing knowledge of a large division of the animal kingdom which has ever been produced ;" which would be true, if, for 'existing knowledge,' we were to read, 'knowledge existing twenty years ago.' Notwithstanding its great merits, the work of Bronn is now antiquated in many respects, as well as out of print, yet, so far, has found no worthy successor. If to the admirable and careful exposition of previous systematic work, characteristic of Bronn's monograph, Professor Lankester will join the biological results of the last twenty years, bringing both up to date, he will merit even higher

praise than that he has bestowed upon the German naturalist.

The plan of the work we are reviewing is excellent. In place of attempting a hard and fast definition of the molluscan phylum, he has described and figured an architypal mollusk in detail; and the reader, once familiarized with this type, can follow clearly the discussion of the subordinate branches. These are taken up seriatim, beginning with the more archaic forms. The phylum is divided by Lankester into two great branches,—the Glossophora and the Lipocephala. The first comprises three classes,—Gastropoda (in its widest sense); Scaphopoda, or the Dentalia; and Cephalopoda, with which the author includes not only the cuttles, etc., but the Pteropoda. The Lipocephala are equivalent to the Acephala of Cuvier, or the Lamellibranchiata of authors.

So far, the position of the Pteropoda (though not absolutely new) with the Cephalopoda, rather than as a class by themselves or as a subclass of Gastropoda, is the chief difference from the generally accepted classifications, and one which will be much criticised, if not finally rejected; since the little that is known of the embryology of the pteropods differs in important features from that of the cephalopods.

The Gastropoda are first discussed in a general way, and, on the whole, in a most satisfactory manner. We could wish, that, in introducing new Greek derivatives, some attention had been paid to euphony; for surely that melodious language can afford better terms than *gonad* ('sexual organ'), *osphradium* ('sensory organ'), *ctenidium* ('gill'), and others which grate upon the ear. We note among details the erroneous statement that the radula is horny (it is really chitinous), and that the jaws are usually calcified, and almost universally present. No single instance of a calcified jaw among recent Mollusca occurs to us, and there are large groups without a jaw. The jaw is composed of a substance allied to chitine, more or less combined with really horny material, the former defying alike the strongest acids and alkalis to reduce it.

The recognition of the radula as a feature of the highest systematic importance is very welcome: it is only to be regretted that the author seems to have fallen into utter confusion in his endeavors to indicate formulae for the teeth, and to have followed, without much investigation, the crude notions of Dr. Macdonald, rather than the researches of Troschel, Lovén, Woodward, or Sars. It seems also to have escaped him, that the radula is occasionally (though rarely) absent.

The author divides the Gastropoda into two subclasses, Isopleura and Anisopleura, characterized by the relations of the organs, which, in the former and more archaic group, are bilaterally symmetrical with a posterior anus: in the Anisopleura the visceral mass has been subjected to torsion, bringing the anus to the anterior right side, while the concomitant twisting of the remainder of the intestinal mass results in a masking of the original symmetry. In the process when originally brought about, if the termination of the intestine was sufficiently low, it became entangled in the pedal nervous loop, which, in following it, acquired a figure-of-eight form. If, on the other hand, the plane of intestinal torsion was above the pedal loop, the latter did not participate in the torsion, and in the succeeding generations retained its simple character. These relative features, observed by Spengel in a number of mollusks, are made, after him, the occasion of two super-ordinal groups,—Streptoneura and Euthyneura.

We regard the establishment of the subclasses above mentioned as a decided advance on previous systems, while it is doubtful if the super-orders will stand the test of future investigation. The character adopted as a basis is purely mechanical, and, so far as yet shown, without serious significance.

The isopleurous gastropods comprise the Chitons, Neomeniidae, and Chaetoderma, which are considered respectively as typifying orders. In our opinion, they should have been divided into two super-orders,—one the Polyplacophora, exhibiting a metameric repetition of the primitive shell-sac, and possessing a developed and functional foot; the other the Chaetodermitida, without (as adults) a primitive shell-sac or shell of any kind, and with the foot aborted, or rudimental. The statement (p. 641) that the cuticular spines of the latter group 'replace' the shell, is not correct in a strictly scientific sense, and the expression were better not used; for these spines are absolutely identical with the spines of the girdle in Chiton, and have no relation to the true shell.

The Anisopleura Streptoneura are divided into two orders, Zygo- and Azygo-branchia, accordingly as the suppression of the originally left-side organs is or is not carried out. These characters we regard as unsatisfactory, and the division resulting as artificial; Haliothis, Fissurella, etc., being combined with the true limpets, while their (to our notion) much nearer relatives, the Trochidae, Pleurotomariidae, etc., are left in the other order. Recent observations on the limpets indicate that this arrangement cannot be maintained, though we

have not space for a full statement of the case.

It should be said, that only examples of groups in classification as high as families appear in the work. Of about two hundred and seventy-five families of mollusks recognized by malacologists of later date than Bronn, about seventy only are referred to; and the genera assigned to some of these are not at present considered to be properly so placed. This, however, is a mere incident, which greater research into the present state of the science, outside the ranks of professional embryologists, will make it easy to rectify.

The Streptoneura comprise a large part of the ordinary marine gastropods bearing shells, but to them are added the heteropods. On the other hand, the Euthyneura comprise the nudibranchs, pulmonates, and opisthobranchs, — a not unnatural assemblage, but which should hardly be kept out where *Pyramidella*, *Entoconcha*, and *Phyllirhoë* are let in. We do not find any indication of the place of *Siphonaria* or *Gadinia*.

The *Solenococoncha* stand alone. That the *Pteropoda* should do so, rather than have been consolidated with the *Cephalopoda*, many will be disposed to believe, as Lankester admits that the development of the embryo 'presents no points of contact' between them.

In the *Lipocephala*, unfortunately, we have nothing new; and the old and now defunct orders based on the number of adductor muscles are retained.

The remarkable characters of the group of *Metarrhiptae* are not alluded to; and *Tridacna*, the type, is actually included in one family with *Dimya*, *Isocardia*, *Cyrena*, and *Cyprina*. In fact, the families of *Lipocephala* adopted are, in the light of modern investigations, too archaic for serious criticism.

We have noticed, in passing, some errors, and some features wherein we differ from our author in judgment on the facts presented. But we should do him grave injustice if we did not, before closing this review, give our testimony to the great value of his work.

In this paper is brought together the best summary of the results of recent anatomical and embryological research on the Mollusca. It is fully (though rather rudely) illustrated with fresh and well-selected figures. Several of the diagrammatic series given are extremely clear, satisfactory, and instructive. The article is a mine of information as to anatomy and development, digested and put in rational sequence. It is, however, a sketch, in broad outlines, of the developmental history of the

Mollusca, rather than a general treatise on the group. We hope that it, or an enlarged and improved treatise following on the same lines, may soon be accessible in better form for the student, whom it cannot fail to stimulate and instruct.

W. H. DALL.

#### ABORIGINAL LITERATURE OF AMERICA.

*Aboriginal American authors and their productions, especially those in the native languages.* By DANIEL G. BRINTON. Philadelphia, Brinton, 1883. 63 p. 8°.

*The Güegüence: a comedy ballet in the Nahuatl-Spanish dialect of Nicaragua.* Edited by D. G. BRINTON. Philadelphia, Brinton, 1883. 52+94 p. 8°.

THE first of these papers is an essay which grew out of a communication which Dr. Brinton made, in 1883, to the Copenhagen session of the *Congrès des Américanistes*. It is a bit of literary history, which groups, according to form of expression, — whether narrative, didactic, oratorical, poetic, or dramatic, — the various productions of the aborigines of America. It includes the writings in the native tongues of the Maya and Nahuatl races in the south. It embraces, also, the hot-bed literature of those tongues which have received their power of expression, in type, from the contact with the whites; as in the case, for instance, of the Cherokees. Nor are the efforts forgotten, of the training of those of Indian blood who have given expression both in the Latin, which was the common scholarly medium of the time of the Spanish conquest, and in the vernaculars which were acquired from the schools of the Spanish, French, and English settlers. This last phase extends the range pretty far beyond the scope of the linguistic interests attaching to the subject: but Dr. Brinton does not make it an essential part of his plan; and from his enumerations it clearly appears how much more receptive the nations which the Spaniards encountered were than the peoples of the north, brought to subjection by the French and English. The review which Dr. Brinton makes of the literary activity — if we may so call it — of all the American peoples, from the Eskimo southward, though but cursory, is a reasonably complete one, and opens a subject of great interest.

The second title is the third in a series of aboriginal American literature, which Dr. Brinton is giving opportunely to the students of the ethnological development of our indigenous races. In the present instance the